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(71) Applicant *(for all designated States except US)*: COMPACTION TECHNOLOGY (SOIL) LIMITED [GB/GB]; c/o Sydney de Leon of Talbot House, 204–226 Imperial Drive, Harrow, Middlesex HA2 7HH (GB).

(72) Inventors; and
(75) Inventors/Applicants *(for US only)*: COOK, Eric, Johnstone [ZA/ZA]; 57 Somerset Street, Ferryvale, Nigel 1491 (ZA). MIJBURGH, Christoffel, Avril [ZA/ZA]; 13 Fairbridge Street, Benoni 1500 (ZA).

(74) Agents: GILSON, David, Grant et al.; Spoor and Fisher, P.O. Box 41312, Craighall 2024 (ZA).

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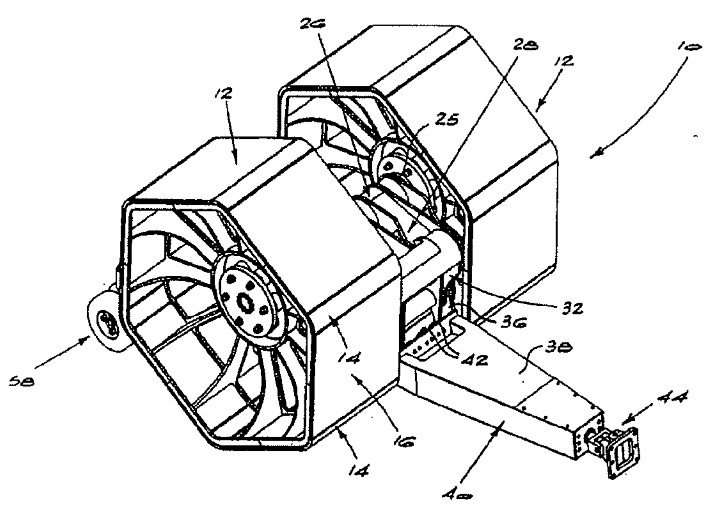

(57) Abstract

The invention concerns a soil compaction machine (10) which comprises a wheeled carriage (40) and spaced apart, out-of-round compactor masses (12) suspended relative to the carriage. The periphery of each mass (12) is defined by spaced apart salient points (14) and intermediate compacting faces (16) between the salient points. The salient points and compacting faces are arranged such that when the mass (12) is rolled over a soil surface it alternately rises up on each salient point (14) in turn, thereby storing potential energy, and then descends onto the following compacting face (16) to deliver the stored energy to the soil to compact it. In accordance with the invention, the masses (12) are independently suspended relative to the carriage (40).

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SOIL COMPACTION MACHINE

BACKGROUND TO THE INVENTION

THIS invention relates to a soil compaction machine.

Machines according to the invention may operate as impact compactors. The specification of EP 0 017 511 to A R Berrange describes a dual mass impact compactor which has two compactor masses mounted on a common axle structure. As is common in impact compactors, each mass has a non-circular profile with spaced apart salient points followed, in the direction of rotation, by compacting faces. When the masses are rolled over a soil surface which is to be compacted, each mass alternatively rises up on its salient points, thereby storing potential energy, and then falls forwardly so that the stored potential energy is delivered by the following compacting face, as an impact blow, to the soil surface. The common axle structure described in the specification of EP 0 017 511 constrains the two compactor masses to rotate substantially in unison.

Although dual mass impact compactors of the type described in the specification of EP 0 017 511 have been used successfully for a number of years to achieve high levels of soil compaction to considerable depths below the soil surface, such compactors are not entirely satisfactory. One particularly important drawback with such machines arises from the considerable bending, torsional and other stresses to which the common axle structure is subjected in use. Apart from the potential for failure of the axle structure, the high stresses result in considerable shock loads being applied both to the impact compaction machine and to the tractive vehicle.

SUMMARY OF THE INVENTION

According to the present invention there is provided a soil compaction machine comprising a wheeled carriage, spaced apart, out-of-round compactor masses suspended relative to the carriage, each mass being defined peripherally by spaced apart salient points and intermediate compacting faces between the salient points, the arrangement of the salient points and compacting faces being such that when the mass is rolled over a soil surface it alternately rises up on each salient point in turn, thereby storing potential energy, and then descends onto the following compacting face to deliver the stored energy to the soil to compact it, characterised by suspension means which independently suspend the masses relative to the carriage.

The machine may be an impact compaction machine in which the shape and arrangement of the salient points and compacting faces is such that potential energy which is stored by each mass when it rises up on its salient points is delivered as a series of periodic impact blows to the soil by the following compacting faces.

In the preferred embodiment, the machine comprises two compactor masses, an upright drop link structure pivoted at or towards its lower end to the carriage, a pair of drag links pivoted to the drop link at or towards the upper end of the drop link and a pair of stub axles carried rotatably by the drag links, the masses being mounted on the stub axles.

To enable full compaction of a given soil area it is preferred that the transverse width of each mass exceed the clear spacing between the masses.

Constraint means may be provided for constraining the two compactor masses to rotate substantially synchronously. Such means may, for instance, comprise chain and sprocket mechanisms acting between the stub axles and a transverse shaft carried by the drop link.

The carriage may include a chassis mounted on a central wheel between the masses and on spaced apart wheels trailing the masses, means being provided which are operable to raise the spaced apart trailing wheels relative to the chassis and to raise the compactor masses relative to the carriage to travel over the ground in a non-compacting mode with the masses elevated off the ground. The chassis may carry coupling means at its leading end for coupling the carriage to a tractive vehicle, the coupling means being movable relative to the chassis and the machine comprising damping means for damping movements of the coupling means relative to the chassis.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will now be described in more detail, by way of example only, with reference to the accompanying drawings in which:

Figure 1 shows a perspective view of an impact compaction machine according to the present invention;

Figure 2 shows a plan view of the machine seen in Figure 1;

Figure 3 shows a side view of the machine; and

Figure 4 shows a view of the machine looking in the direction of the arrow 4 in Figure 3.

DESCRIPTION OF A PREFERRED EMBODIMENT

The drawings illustrate a dual mass soil compaction machine 10, according to this invention, which acts as an impact compactor. The two compactor masses of the machine 10 are each indicated with the reference numeral 12. As illustrated, each mass 12 has a six-sided configuration, with equispaced salient points 14 alternating with flat compacting faces 16. In each compactor mass 12, the salient points 14 and faces 16 are provided by tread plates 18 and 20 mounted to spoke structures 22 radiating from a central hub structure 24. The tread plates are stiffened by stiffeners 21.

The hub structures 24 are mounted fast to the ends of independent stub axles 25 which are carried rotatably in bearing structures 26 which are located at the trailing ends of laterally spaced drag link structures 28. The drag link structures are pivoted via a transverse shaft 30 to the upper end of a drop link 32 which is common to both compactor masses. The drop link 32 is pivoted via a shaft 34 to brackets 36 carried by a rigid chassis 38 forming part of a wheeled carriage designated generally by the numeral 40. Damping rubbers 42 are mounted to the chassis 38 opposite the lower end of the drop link 32, below the pivot shaft 34.

The forward end of the chassis 38 carries a coupling structure 44 by means of which the machine 10 can be coupled in trailing relationship to a tractor (not shown). The coupling structure 44 includes a shaft 46 which is capable of limited fore and aft sliding movement relative to the chassis. A linear damper,

indicated diagrammatically in Figure 3 with the numeral 48, is provided within the structure of the chassis to damp fore and aft sliding movement of the shaft 46 relative to the chassis.

The chassis 38 is suspended resiliently via rubber dampers 50 on a central, ground engaging wheel 52 located between the compactor masses 12. Connected pivotally to the rear end of the chassis, via a pivot shaft 54, is a transverse wheel support beam 56. Opposite ends of the wheel support beam 56 carry spaced apart wheels 58 via bearings 60 which allow the wheels to pivot about upright axes in the manner of castors. An hydraulic cylinder 62 acts between the chassis and the wheel support beam as shown. It will be appreciated that with the coupling structure 44 coupled to a tractor and the wheel 52 on the ground, contraction of the cylinder 62 will raise the beam 56 and wheels 58 off the ground. From their raised position, extension of the cylinder 62 will bring the wheels 58 back into contact with the ground.

On each side of the carriage, beneath the respective stub axle bearing structures 26, there is a curved cradle 64 which is pivoted at its leading end to the drop link 32 at the shaft 34. At their rear ends the cradles 64 are connected to a transverse shaft 66 supported pivotally by brackets 68 connected to an upright hydraulic cylinder 70. Extension of the cylinder 70 will pivot the cradles 64 upwards, in a clockwise sense, as viewed in Figure 3. With sufficient extension of the cylinder 70, rubber bumpers 72 on the upper surfaces of the cradles 64 are brought into contact with the undersides of the stub axle bearing structures 26 and raise those structures, and with them the compactor masses 12, off the ground. This procedure is followed in situations where the machine 10 is to be transported in a non-compacting or carry mode. It will be understood that in this mode, the machine 10 enjoys a considerable amount of stability about the fore and aft axis by virtue of the fact that it is

supported by the central wheel 52 and the spaced apart rear wheels 58.

Chain sprockets 74 are mounted fast on the inner ends of the stub axles 25 and are aligned with similar sprockets 76 fast on the shaft 30. Chains 78, indicated in Figure 2 by chain-dot lines, pass around the sprockets 74 and 76 and intermediate tensioning sprockets (not shown).

In order to compact a soil surface, the coupling structure 44 is coupled to the tractor (not shown). The wheels 58 are raised off the ground by contracting the cylinder 62, as described above. With the tractor driven forwardly, i.e. to the right in Figure 3, traction is applied to the compactor masses 12 via the chassis 38, drop link 32, drag link structures 28 and stub axles 25. Each mass goes through a repetitive process of rising up on a salient point 14, thereby storing potential energy, and falling forwardly and downwardly for the next succeeding compacting face to deliver the stored energy to the soil surface in an impact blow.

The chain and sprocket mechanism described above positively constrains the compactor masses 12 to rotate in unison with one another, i.e. synchronously. It has however been found in initial tests with a prototype machine that even without the chain and sprocket mechanisms, the masses tend to rotate substantially synchronously.

The falling motion of the masses as they pass over their respective salient points 14 is largely taken up by the pivotal motion of the traction assembly and in particular the drag link structures and drop link. Further damping is provided by the lost motion permitted by sliding movement of the shaft 46 relative to the chassis, such movement being damped by the damper 48 as described above. It has been observed in initial tests that these features result

in very little shock loading being applied to the tractor. The traction which is then applied to raise the masses on to their next salient points is damped by the damping rubbers 42.

The independent suspension of the compactor masses 12 is considered to be a major advantage of the invention when compared to prior arrangements in which the masses are connected to one another by a common axle structure, primarily in view of the reductions in shock loading in the machine itself and as applied to the tractor, as described above. Particularly in cases where the masses are not positively constrained to rotate in synchronism, it is believed that the independent suspension of the masses will render them suitable for a wide variety of applications where site conditions may vary from one point to the next.

A further advantage of the machine as described above arises from the fact that the transverse width of each compactor mass 12 is greater than the clear spacing between the inner edges of the masses. This means that the strip of soil which is not contacted directly by the masses on each pass can easily be covered by one of the masses on the next pass.

CLAIMS

1.

A soil compaction machine comprising a wheeled carriage, spaced apart, out-of-round compactor masses suspended relative to the carriage, each mass being defined peripherally by spaced apart salient points and intermediate compacting faces between the salient points, the arrangement of the salient points and compacting faces being such that when the mass is rolled over a soil surface it alternately rises up on each salient point in turn, thereby storing potential energy, and then descends onto the following compacting face to deliver the stored energy to the soil to compact it, characterised by suspension means which independently suspend the masses relative to the carriage.

2.

A soil compaction machine according to claim 1 wherein the machine is an impact compaction machine in which the shape and arrangement of the salient points and compacting faces is such that potential energy which is stored by each mass when it rises up on its salient points is delivered as a series of periodic impact blows to the soil by the following compacting faces.

3.

A soil compaction machine according to claim 1 or claim 2 wherein the machine comprises two compactor masses, an upright drop link structure pivoted at or towards its lower end to the carriage, a pair of drag links pivoted to the drop link at or towards the upper end of the drop link and a pair of stub axles carried rotatably by the drag links, the masses being mounted on the stub axles.

4.

A soil compaction machine according to claim 3 wherein the transverse width of each mass exceeds the clear spacing between the masses.

5.

A soil compaction machine according to any one of the preceding claims comprising constraint means for constraining the two compactor masses to rotate substantially synchronously.

6.

A soil compaction machine according to claim 5 wherein the constraint means comprises chain and sprocket mechanisms acting between the stub axles and a transverse shaft carried by the drop link.

7.

A soil compaction machine according to any one of the preceding claims wherein the carriage includes a chassis mounted on a central wheel between the masses and on spaced apart wheels trailing the masses.

8.

A soil compaction machine according to claim 7 comprising means operable to raise the spaced apart trailing wheels relative to the chassis.

9.
A soil compaction machine according to claim 7 or claim 8 comprising lifting means operable to raise the compactor masses relative to the carriage to travel over the ground in a non-compacting mode with the masses elevated off the ground.

10.
A soil compaction machine according to any one of claims 7 to 9 comprising coupling means at a leading end of the chassis for coupling the carriage to a tractive vehicle.

11.
A soil compaction machine according to claim 10 wherein the coupling means is movable relative to the chassis, the machine comprising damping means for damping movements of the coupling means relative to the chassis.

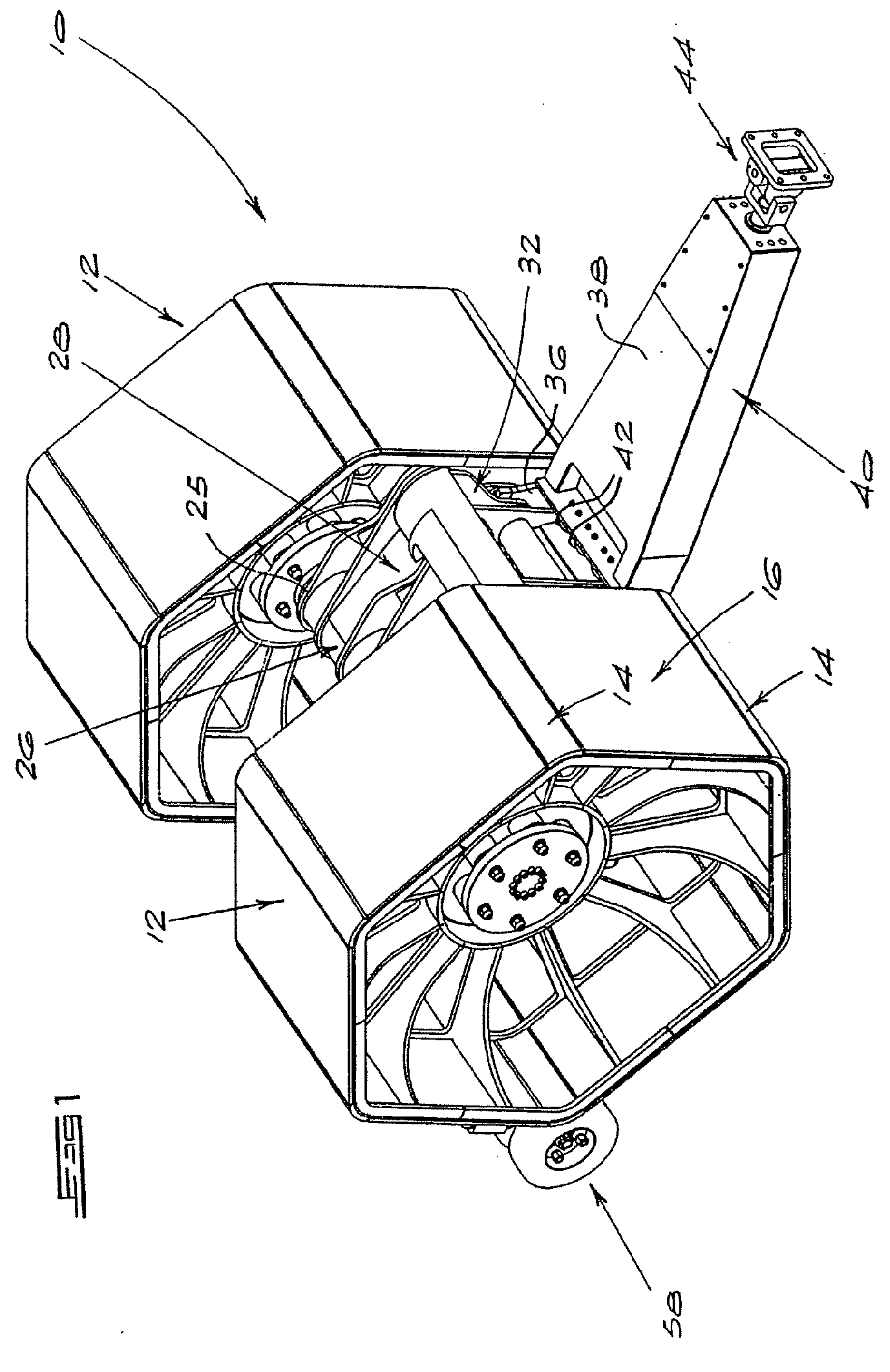
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Fig. 3

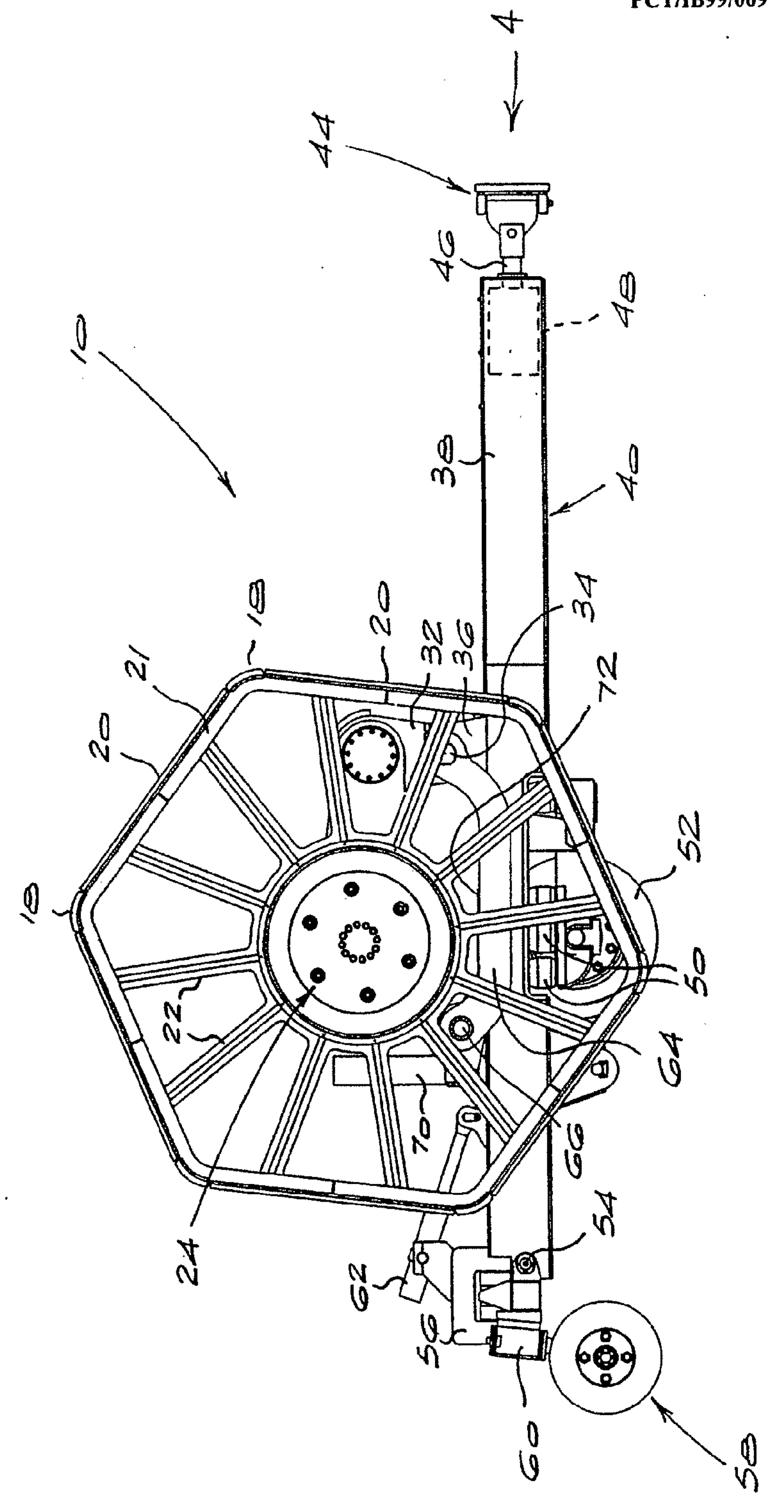

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FIG 4